



TITLE: Methods and Apparatus for Controlling Refrigerators  
INVENTOR: Alexander P. Rafailovich, et al.  
Serial No: 10/743,628 Atty. Dkt. No.: 9D-HR-25242  
Atty. Name: Thomas M. Fisher, (314) 621-5070

1/9

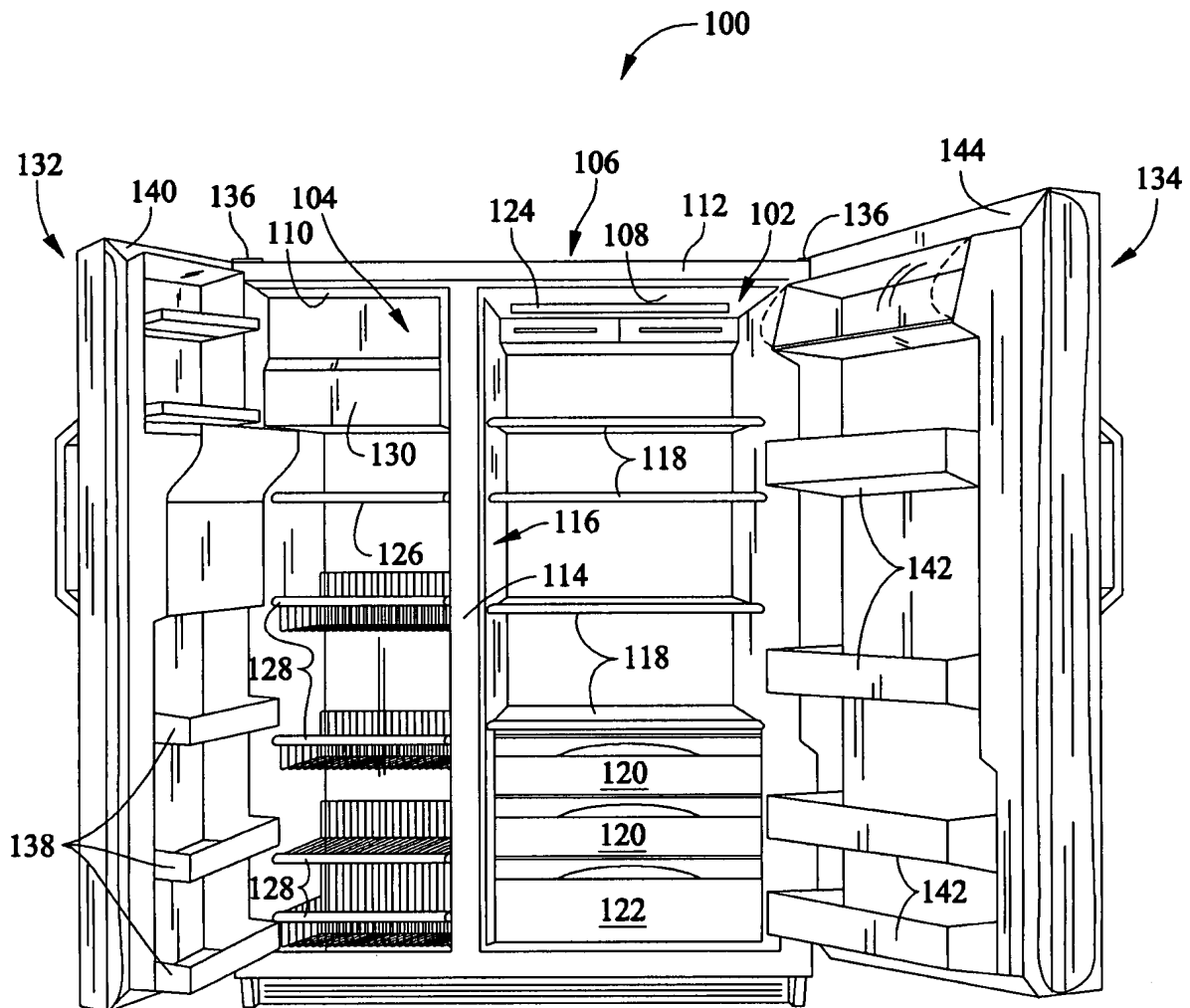
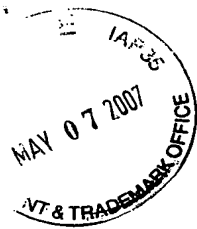


FIG. 1



2/9

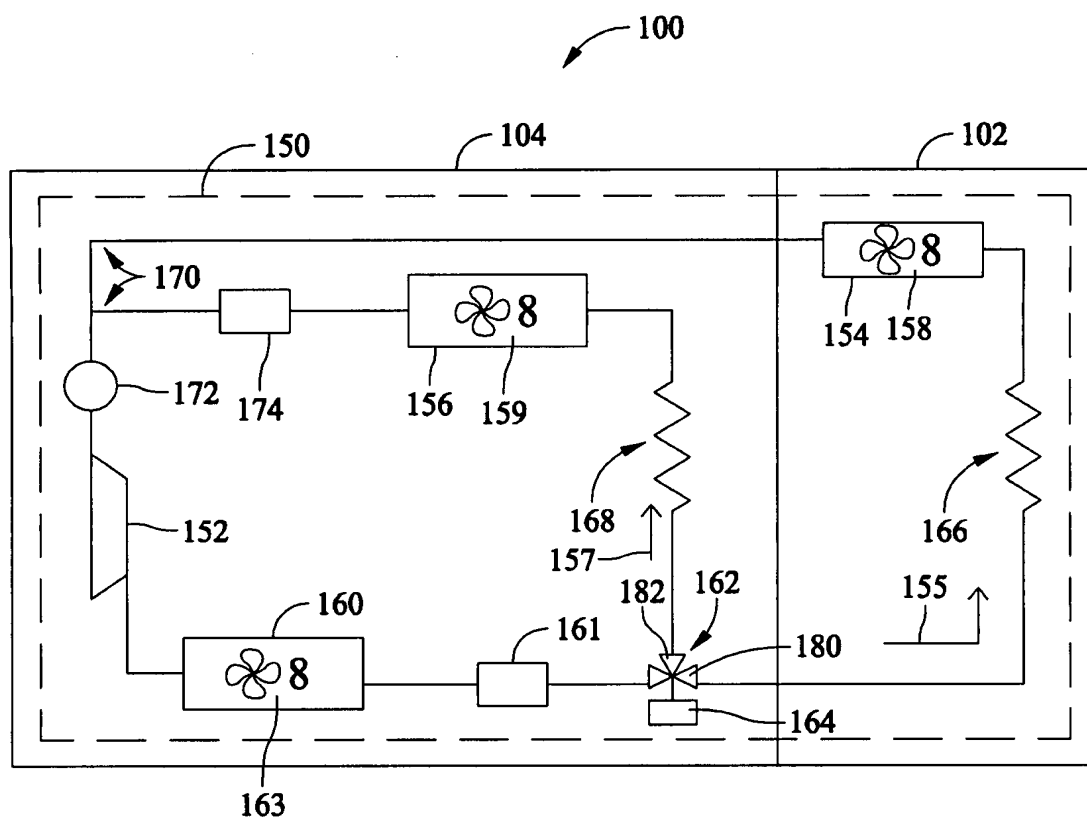


FIG. 2



3/9

200 →

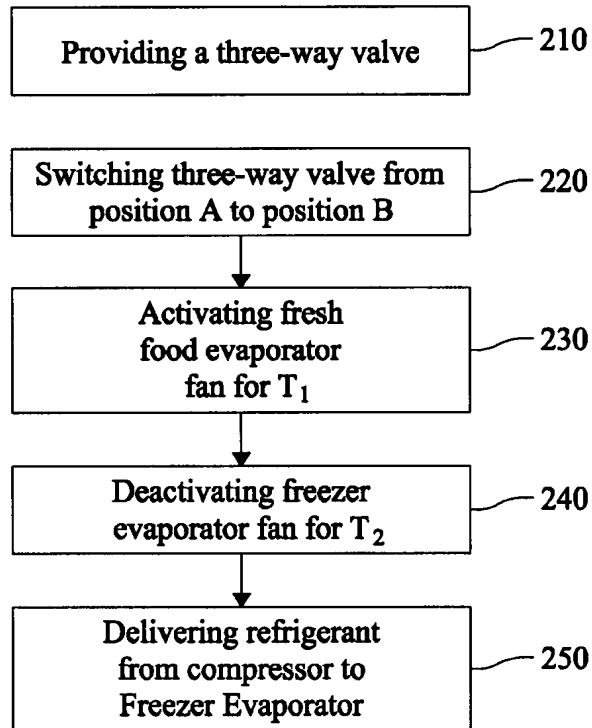


FIG. 3



4/9

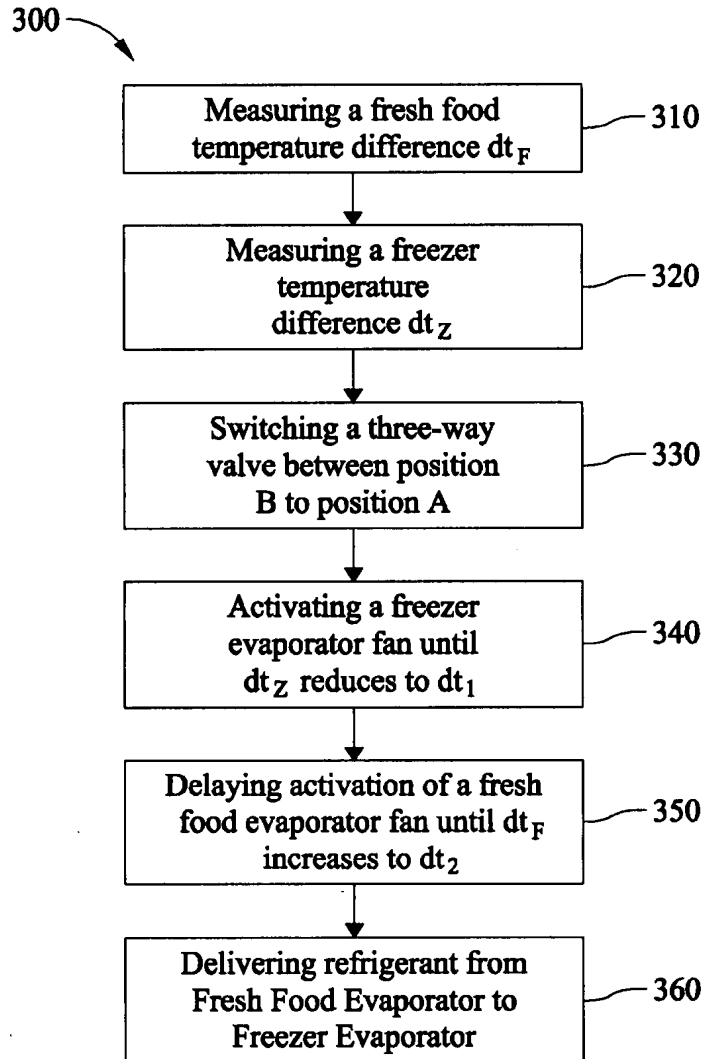


FIG. 4



TITLE: Methods and Apparatus for Controlling Refrigerators  
 INVENTOR: Alexander P. Rafalovich, et al.  
 Serial No: 10/743,626 Atty. Dkt. No.: 9D-HR-25242  
 Atty. Name: Thomas M. Fisher, (314) 621-5070

5/9

Y 420 FZ EXTREME	30 AE Area = Area5 COMP MED/Cond - SuperHI FZ Fan HI Valve B FF Fan Off	31 AF Area = Area5 COMP MED/Cond - SuperHI FZ Fan HI Valve B FF Fan Off	32 AH Area = Area7 COMP MED/Cond - SuperHI FZ Fan HI Valve NC FF Fan NC
	0 A Area = Area5 Comp/Cond HI FZ Fan HI Valve B FF Fan Off	1 B Area = Area5 Comp/Cond HI FZ Fan HIGH Valve B FF Fan Off	2 C Area 1 If (Valve Not A) Area = Area1 Comp/Cond HI FZ Fan High Valve NC FF Fan NC
FZ HIGH HYST 3 (FZXXHHyst)	6 G Area = Area5 Comp/Cond Med FZ Fan Med Valve B FF Fan Off	7 H Area = Area5 Comp/Cond Med FZ Fan Med Valve B FF Fan Off	8 I Area 2 If NOT from Area 1 Area = Area2 If (Area Not Area3) Comp/Cond Med If (Valve NOT A) Fz Fan High Valve NC FF Fan NC
FZ HIGH HYST 2 (FZXHHyst)	12 M Area = Area5 Comp/Cond LOW FZ Fan Low Valve B FF Fan Off	13 N Area = Area5 Comp/Cond Low FZ Fan Low Valve B FF Fan Off	14 O Area 3 If Area = Area 1 Comp/Cond Med, FZ Fan HI Valve C, Area = Area2 else Comp/Cond Low, If Valve not A FZ-Fan Low Area = Area3 FF Fan NC
FZ HIGH HYST 1 (FZH HHyst)	18 S Area = Area5 Comp/Cond NC FZ Fan NC Valve NC FF Fan Off	19 T Area = Area5 if (Comp/Cond On) Comp/Cond Low, FZ Fan Low Valve B else Valve A, Comp/Cond NC, Fz Fan NC FF Fan Off	20 U Area 4 If Area = Area 2 Comp/Cond Med, Fz Fan Off Valve A, Area = Area3 else Comp/Cond NC, Valve NC, FZ Area = Area4 FF Fan NC
FZ Target Temp			
FZ Low Hysteresis	24 Y Area = Area0 Comp/Cond OFF FZ Fan, OFF Valve A FF Fan Off	25 Z Area = Area0 Comp/Cond OFF FZ Fan, OFF Valve A FF Fan Off	26 AA Area = Area0 Comp/Cond Off FZ Fan OFF Valve A FF Fan Off

Figure 5B

400

FIG. 5A

Figure 5C



33 AH Area = Area7 COMP MED/Cond - SuperHI Fz Fan Med Valve C FF Fan MED	34 AI Area = Area7 COMP MED/Cond - SuperHI Fz Fan Med Valve C FF Fan MED	35 AJ Area = Area7 COMP MED/Cond - SuperHI Fz Fan Med Valve C FF Fan MED
3 D Areal Area = Areal Comp/Cond HI Fz Fan High Valve C FF FAN LOW	4 E Areal Area = Areal Comp/Cond HI Fz Fan High Valve C FF FAN MED	5 F Areal Area = Areal Comp/Cond HI Fz Fan High Valve C FF FAN High
9 J Area2 If NOT from Area 1 Comp/Cond Med, Fz Fan HI Area = Area2 Valve C FF Fan Low	10 K Area2 If NOT from Area 1 Comp/Cond Med Fz Fan High Valve C FF FAN MED Area = Area2	11 L Areal Area = Area 1 Comp/Cond HIGH Fz Fan Off Valve A FF FAN High
15 P Area3 If Area = Area1 Comp/Cond Med, Fz Fan HI Valve C else Comp/Cond Low, Fz Fan Off Valve A, Area = Area3 FF Fan Low	16 Q Area2 If NOT from Areal Comp/Cond Med Fz Fan Off Valve A Area = Area2 FF FAN MED	17 R Areal Area = Areal Comp/Cond Med Fz Fan Off Valve A FF FAN HIGH
21 V Area3 Comp/Cond Low, Fz Fan Off Valve A Area = Area3 FAN LOW	22 W Area2 Comp/Cond Med Fz Fan Off Valve A Area = Area2 FF FAN MED	23 X Areal Area = Areal Comp/Cond Med Fz Fan Off Valve A FF FAN High
27 AB Area = Area6 Comp/Cond LOW Fz Fan Off Valve A FF FAN LOW	28 AC Area = Area6 Comp/Cond LOW Fz Fan Off Valve A FF FAN MED	29 AD Area = Area6 Comp/Cond MED Fz Fan Off Valve A FF Fan High

Figure 5A

Figure 5B

Figure 5D

Figure 5A



Figure 5D

FF Target Temp

FF Low Hysteresis

FF No  
Freez

If Valve is in A position FZFan is off and FFFan runs at least in Low Speed

If Valve is in B position FZFan runs at least in Low speed and FFFan is off

NOTE (1): DAMPER OPENS & FF FAN ON LOW AT SS START, THEN CHECKS FOR PROPER POSITION NEXT LOGIC CYCLE

NOTE (2): FOR BPO & QUANTUM FZ Fan MEDIUM NA

NOTE (3): If the FF temperature has not gotten colder by 0.15F within 30 minutes of the damper opening, boost the FZ Fan fz

NOTE (4): EFOSSO = evaporator fan on sealed system off (part of the configuration byte)

FFRollAvg = FFTHERMIST

FZRollAvg = FFTHERMIST

FFLTAVG3 = Beta \* FFLTAVG3 + (1 - Beta) \* FFRollAvg \* added by RMB 6/1

FZLTAVG3 = Beta \* FZLTAVG3 + (1 - Beta) \* FZRollAvg \* added by RMB 6/1

FFLTAVG2 = Beta \* FFLTAVG2 + (1 - Beta) \* FFLTAVG3 \* added by RMB 6/1

FZLTAVG2 = Beta \* FZLTAVG2 + (1 - Beta) \* FZLTAVG3 \* added by RMB 6/1

FFLTAVG = Beta \* FFLTAVG + (1 - Beta) \* FFLTAVG2 \* moved by RMB 6/1/

FZLTAVG = Beta \* FZLTAVG + (1 - Beta) \* FZLTAVG2 \* moved by RMB 6/1/

400

FIG. 5C

Figure 5C

FF HIGH  
HYST 1  
(FFHI  
Hyst)

FF HIGH  
HYST 2  
(FFXHI  
Hyst)

FF HIGH  
HYST 3  
(FFXXHI  
Hyst)

400

Figure 5B



*If Valve is in C position FZ and FF fans run at least in Low speed*

NOTE (5): ONF = obey no freeze limit (part of the configuration byte)

NOTE (6): MS = medium speed (part of the configuration byte)

NOTE (7): See included worksheet in order to calculate the configuration byte

If (FFLTAVG - {TFFTARGET + FFOFF} > 1) Then  
 FFERROR = FFERROR - 0.1  
 Elseif (FFLTAVG - TFFTARGET - FFOFF > 0.2) Then  
 FFERROR = FFERROR - 0.02  
 Elseif (FFLTAVG - TFFTARGET - FFOFF < -1) Then  
 FFERROR = FFERROR + 0.1  
 Elseif (FFLTAVG - TFFTARGET - FFOFF < -0.2) Then  
 FFERROR = FFERROR + 0.02

End if

If FFERROR > FFHHyst+2 Then FFERROR = FFHHyst+2  
 If FFERROR < FFLowHyst Then FFERROR = FFLowHyst

If (FZLTAVG - TERTARGET - FZOFF > 1) Then  
 FZERROR = FZERROR - 0.1  
 Elseif (FZLTAVG - TERTARGET - FZOFF > 0.2) Then  
 FZERROR = FZERROR - 0.02  
 Elseif (FZLTAVG - TERTARGET - FZOFF < -1) Then  
 FZERROR = FZERROR + 0.1  
 Elseif (FZLTAVG - TERTARGET - FZOFF < -0.2) Then  
 FZERROR = FZERROR + 0.02

End if

If FZERROR > FZHHyst Then FZERROR = FZHHyst  
 If FZERROR < FZLowHyst Then FZERROR = FZLowHyst

FIG. 5D



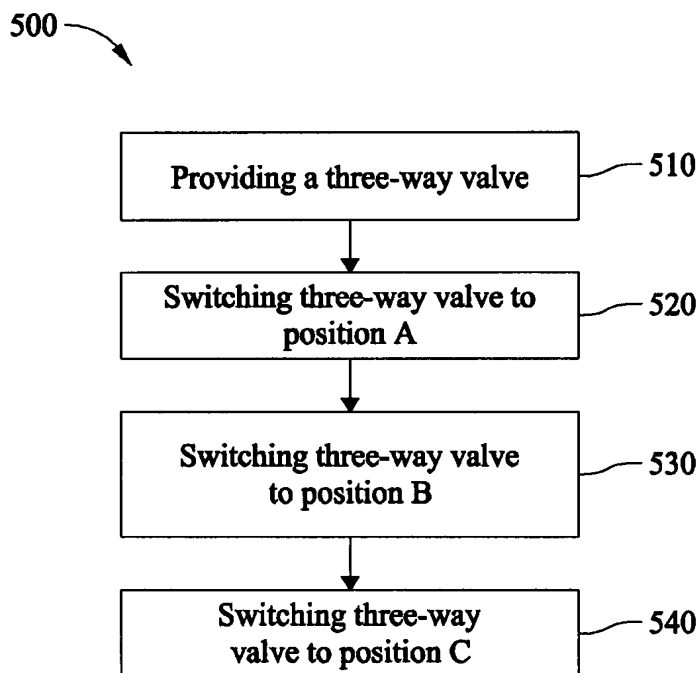


FIG. 6